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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/050,322	01/15/2002	Ming Huan Tsai	67,200-613	3498

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EXAMINER

BARRECA, NICOLE M

ART UNIT PAPER NUMBER

1756

DATE MAILED: 12/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/050,322

Applicant(s)

TSAI ET AL.

Examiner

Nicole M Barreca

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 28 October 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1,3,5,7,11-13,21-26 and 30-38 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3,5,7,11-13,21-26 and 30-38 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_

**DETAILED ACTION**

1. Claims 1, 3, 5, 7, 11-13, 21-26 and 30-38 are pending in this application.
2. The after-final amendment of claims 7, 11 and 21, filed 10/27/04, has been entered. The objection of claim 32 and 35 USC 112, second paragraph rejection of claims 7 and 11 are withdrawn in response.
3. In view of the appeal brief filed on 10/28/04, PROSECUTION IS HEREBY REOPENED. New grounds of rejection are set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

- (1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,
- (2) request reinstatement of the appeal.

If reinstatement of the appeal is requested, such request must be accompanied by a supplemental appeal brief, but no new amendments, affidavits (37 CFR 1.130, 1.131 or 1.132) or other evidence are permitted. See 37 CFR 1.193(b)(2).

***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:  

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
5. Claims 12, 26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

It is unclear what step of etching is referred to in claims 26.

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It is unclear when the second resist layer is removed in claims 12 and 26. Is it removed with the first layer (and therefore must be after the (second) etching) as recited in the independent claims or prior to the (second) etching as recited in claims 12 and 26?

***Claim Rejections - 35 USC § 102***

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 1, 3, 5-13, 20, 21, 22, 24-26, 31-33, 35 are rejected under 35

U.S.C. 102(e) as being anticipated by Ohuchi (US 6576562).

8. Ohuchi discloses a method for making a semiconductor device using a resist mask pattern. Interlayer insulating film 202 is formed on a silicon substrate 201, followed by barrier film 203, first metal wiring layer 204, barrier film 205 and interlayer insulating layer 206. Organic base film 207 (first resist layer), organic silicon oxide film 208 and photoresist 209 (second resist layer) are then formed. Organic base layer 207 is formed for example of polyarylene, phenol novolac or aromatic polycyclic resin (col.23, 22-col.24, 24). Instead of using the multilayered resist system it is permissible to form a mask pattern using a two layers. If two layers are used, the upper photoresist layer will contain an inorganic component such as silicon. The upper photoresist

containing the inorganic component such as silicon is exposed to light through a mask and developed using a development solution (wet developing). The pattern in the upper resist layer is transferred to the lower organic base film using a dry etching process such as RIE using a gas mixture of oxygen (O<sub>2</sub>) and nitrogen (N<sub>2</sub>). Other etching technologies may be used as appropriate such as ICP (col.29, 13-col.30, 33). The upper photoresist layer is removed (ashed) during the etching of the lower resist layer, followed by etching of the underlying layers to transfer the pattern and form the via hole (col.26, 33-56). Examples of suitable exposure wavelength of the method include 193 nm and 157 nm (col.14, 42-54). The lower organic base film 207 is formed at a thickness of 500 nm or 5000 angstroms (col.24, 8-10), while the upper photoresist is formed at a thickness of 300 nm or 3000 angstroms (col.25, 40-43).

***Claim Rejections - 35 USC § 103***

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohuchi as applied to claim 1 above, and further in view of Smith (US 6,388,226).

11. Ohuchi does not disclose having argon in the plasma mixture. Smith teaches that adding a noble gas such as argon to a mixture of O<sub>2</sub> and N<sub>2</sub> will allow the reactive species to be more efficiently transported and therefore will increase the photoresist removal rate (col.15, 29-65). It would have been obvious to one of ordinary skill in the

art to add argon to the N<sub>2</sub>/O<sub>2</sub> plasma mixture in the method of Ohuchi because Smith teaches that adding a noble gas such as argon to a mixture of O<sub>2</sub> and N<sub>2</sub> will allow the reactive species to be more efficiently transported and therefore will increase the photoresist removal rate.

12. Claims 23, 30 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohuchi as applied to claims 1, 25 or 32 above, and further in view of Lee (US 6,569,599).

13. Ohuchi using an organic resinous material for the first resist layer but does not specifically disclose that this first resist layer is an I-line photoresist, an acrylic polymer or polyvinyl alcohol polymer. Lee teaches that a known patterning method includes using an I-line photoresist underlying a silicon containing photoresist (col.1, 32-36). It would have been obvious to one of ordinary skill in the art to use an I-line photoresist as the first resist underlying the silicon containing second resist layer in the method of Ohuchi because Lee teaches that it is known in the art to use an I-line photoresist underlying a silicon containing photoresist.

14. Claims 36-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohuchi as applied to claims 1, 25 or 32 above, and further in view of Moise (US 6,211,035).

15. Ohuchi performs the etching steps in a plasma reactor but does not disclose that it is a dual source RF power plasma reactor. Moise teaches that one way to improve selectivity and etch profile is to use an enhanced plasma generation source such as a dual RF supply (col.13, 11-19). It would have been obvious to one of ordinary skill in

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the art to use a dual source RF supply as the plasma reactor in the method of Ohuchi because Moise teaches that this will improve selectivity and etch profile.

***Response to Arguments***

16. Applicant's arguments filed 10/28/04 have been fully considered but they are not persuasive.

17. The applicant argues that Ohuchi teaches away from the applicant invention by using a lower organic layer having a carbon content of 80 wt%. As written the applicant's claims only require that the first resist layer be non-silicon containing, organic and resinous, all limitations meet by Ohuchi.

18. The applicant argues that the second layer of Ohuchi is not thinner than the first resist layer. This is incorrect. Ohuchi teaches that the lower organic base film 207 is formed at a thickness of 500 nm or 5000 angstroms (col.24, 8-10), while the upper photoresist is formed at a thickness of 300 nm or 3000 angstroms (col.25, 40-43). While respect to Fig. 7A-7F and col.29-31 disclosing the two-layer process, Ohuchi does not repeat all of the details of the multi-layered process previously described, but rather teaches that the two-layer process is the same procedure as described above. See also the fourth embodiment describing a two-layer process wherein the first resist layer is 300 nm and the silylated second photoresist is 100 nm (col.21).

19. The applicant argues that Ohuchi does not disclose an ashing step and or a cleaning step. The applicant's claims as written do not require separate and distinct removal steps. Also the independent claims do not limit the process steps to any specific sequential order. Ohuchi teaches that the resist layers are removed during the

etching process of the underlying layers in a plasma reactor using the same gases as those claimed by the applicant. According to the applicant's specification their ashing/cleaning process is performed in the same plasma chamber as the etching process and includes using the same or similar gases and plasma conditions.

20. The applicant's arguments regarding claims 23, 30, 34 are moot in view of the new grounds of rejection.

21. The applicant argues that silicon is not incorporated from a silylation process. However claims 24 and 31 are written in the alternative and therefore do not require silylation. However the fourth embodiment does teach a silylated photoresist as an example of a silicon containing resist.

22. With respect to Smith, in response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

### **Conclusion**

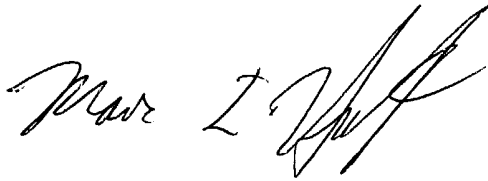
23. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicole M Barreca whose telephone number is 571-272-1379. The examiner can normally be reached on Monday-Thursday (9AM-7PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.



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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Nicole M Barreca *N3*  
Examiner  
Art Unit 1756

12/6/04

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